PATENT SPECIFICATION

835,884

DRAWINGS ATTACHED.

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International Classification :—B04b.

COMPLETE SPECIFICATION.

Separator.

I, THEODORE RUFUS NAYLOR, of 2 Anderson Street, London, S.W.3, a British Subject, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

When hydrocyclones are used for removing dirt from paper pulp or stock, difficulties are often encountered owing to the presence of coarse particles in the feed (paper pulp in water) large enough to cause plugging of the apex nozzles of the small diameter hydrocyclones necessary for efficient dirt removal.

Separation of these coarse particles has proved a difficulty. On the one hand, they cannot be removed by screening, since the screens would also hold back the paper pulp itself and soon become blocked. On the other hand, large diameter hydrocyclones, with apex nozzles unlikely to be plugged, are also unsuitable for the purpose, as the continuous apex discharge results in the loss of a considerable amount of valuable fibre along with the coarse dirt particles, which are usually only present in small quantities.

The object of the present invention is to provide a satisfactory separator for removing solid particles from liquids.

In accordance with the present invention such a separator comprises a vortex chamber in the form of a vessel of circular cross-section, e.g. a conical, cylindrical or cylindro-conical vessel, into which the feed is introduced tangentially and which has an open axial orifice at one end for the discharge of the overflow and a closed axial orifice at the other end with a valve which can be opened from time to time as required to remove the particles which have collected, there being no obstructions which would interfere with the smooth flow of the material being treated throughout the length of the "axial zone" of the vessel. By "axial zone" I mean a zone defined by the volume enclosed by a cylinder having the same radius as the open axial orifice for the discharge of the overflow and extending within the vortex chamber, coaxially therewith, from said open axial orifice to the interior surface of the apex of the vortex chamber. Depending upon the proportions of the separator the latter boundary may be defined either by the interior surface of the conical portion of the chamber or by the inner face of the valve at the end thereof.

The invention is particularly suitable for removing solid particles from the feed material for a hydrocyclone or a battery of hydrocyclones. In this event the said open axial orifice may lead the overflow direct to the hydrocyclone or battery of hydrocyclones, or it may lead the overflow to an overflow splash head or the like having an outlet or outlets to a hydrocyclone or hydrocyclones; such outlet or outlets may be radial, but are not necessarily so—thus they may be tangential or axial.

One form of separator in accordance with the present invention and particularly designed for use in connection with paper pulp cleaning is shown in the drawings filed with the Provisional Specification wherein:—

Fig. 1 is a plan view of the separator; the right half being a section through the line I—I of Fig. 2; and

Fig. 2 is a side view, the left half being in section.

The separator 10 shown in the drawings is cylindro-conical and consists of a cylindrical upper portion 11 and a conical portion 12 leading down to an apex 13 which is closed by a valve 14.

In the cylindrical portion 11 is arranged the tangential feed inlet 15, and across the interior of the portion 11 above the feed

inlet 15 is a plate 16 with a central opening in which is located a short pipe 17 whereby the liquid in the separator can pass into the chamber 18 above the plate. The pipe 17 forms an open axial orifice, and it can be seen from Fig. 2 that the axial zone of the separator 10 (which is a cylindrical zone of the same radius as the internal radius of the pipe 17 extending downwardly along the axis of the separator) is unobstructed over its whole distance from the pipe 17 at the top to the valve 14 at the bottom. As the valve 14 is larger than the internal diameter of the pipe 17 the lower end of the axial zone is determined entirely by the valve 14; if the valve 14 were smaller than the internal diameter of the pipe 17 the lower end of the axial zone would be defined partly by the valve 14 and partly by the wall of the conical portion 12.

The pipe 17 may be omitted, leaving the central opening in the plate 16 through which the liquid can pass and then the radius of this opening would define the radius of the axial zone.

It is preferred that the separator should have no internal parts within the axial zone (as is the case with the separator illustrated) although such internal parts could be tolerated provided that they do not interfere with the smooth flow of the material being treated. Thus for example the operating conditions of the separator might well be such that an axial air core is formed in the separator during operation; a central cylindrical member or "probe" of small diameter lying wholly or mainly within this air core and designed so that it had no adverse effect on the smooth flow of the material being treated could be tolerated, although I prefer that the axial zone should be free from internal parts of every kind.

The separator shown in the drawings is intended to deal with the inlet feed for up to forty-six hydrocyclones which are indicated at 19, the only limitation being that the two hydrocyclones at position 19A in Fig. 1 must be omitted to allow the connection of a pipe to the feed inlet 15.

At the top of the separator is a flange 20 by which the separator is secured to the underside of an overflow splash head 21 for the hydrocyclones 19. This overflow splash head forms no part of the separator except that it provides a lid to close its upper end.

Near the top of the separator are forty-eight radial outlets 22 from the chamber 18; these outlets can be connected to the hydrocyclones 19 by means of lengths of rubber hose 23. The design of the hydrocyclones forms no part of the present invention; three hydrocyclones are shown in Fig. 2, and the positions of twenty-three of the forty-six hydrocyclones are shown in Fig. 1. Each of the hydrocyclones has an apex discharge at the lower end in the usual way and a central overflow outlet 24 at the top of the hydrocyclone leading into the overflow splash head 21. The overflow splash head 21 is capped by a removable cover 25 and is provided with an overflow outlet 26.

The separator can of course be used for a lesser number of hydrocyclones than forty-six, the unused radial outlets 22 being blocked up by a suitable form of plug.

The separator is shown in the drawings as having an apex valve 14 in the form of a pivoted flap which, when the separator is in use, can be opened from time to time by an operator to remove the particles trapped at the apex.

Other forms of valve may be used, for example a butterfly valve. The valve may be adapted to be operated mechanically (for example by mechanical linkages, or hydraulically, or electrically) and may be arranged so that it automatically opens periodically to release the particles trapped at the apex.

In addition to providing means of separating solid particles from the feed, the feed chambers illustrated and described above also provide a satisfactory distribution of the feed between the various hydrocyclones to which the outlets 22 are connected.

The invention is thought to be particularly valuable for use with paper pulp cleaning, but is not limited to this particular application.

WHAT I CLAIM IS:—

1. A separator for removing solid particles from liquids comprising a vortex chamber in the form of a vessel of circular cross-section into which the feed is introduced tangentially and which has an open axial orifice at one end for the discharge of the overflow and a closed axial orifice at the other end with a valve which can be opened from time to time as required to remove the particles which have collected, there being no obstructions which would interfere with the smooth flow of the material being treated throughout the length of the axial zone (as herein defined) of the vessel.

2. A separator according to Claim 1 in which there are no internal parts within the axial zone.

3. A separator according to Claim 1 or Claim 2 in which the vortex chamber is a cylindro-conical vessel the tangential feed inlet being located in the cylindrical portion thereof.

4. A separator according to any one of the preceding claims in which the overflow discharges through a pipe extending into the vortex chamber.

5. A separator according to any one of the preceding claims in which the valve at

the closed axial orifice consists of a pivoted flap.

6. A hydrocyclone assembly comprising a separator according to any one of the preceding claims and a hydrocyclone or battery of hydrocyclones into which is led the overflow from the said open axial orifice.

7. A separator according to any one of Claims 1 to 5 in which there is an overflow splash head or the like into which the said open axial orifice discharges.

8. A hydrocyclone assembly comprising a separator according to Claim 7 and a hydrocyclone or battery of hydrocyclones whose inlet or inlets are connected to outlet or outlets from the overflow splash head or the like.

9. A hydrocyclone assembly according to Claim 8 wherein the outlet or outlets from the overflow splash head or the like are radial.

10. A separator constructed and arranged substantially as shown in the drawings filed with the Provisional Specification and described herein with reference thereto.

11. A hydrocyclone assembly constructed and arranged substantially as shown in the drawings filed with the Provisional Specification and described herein with reference thereto.

12. In the manufacture of paper a method of separating coarse particles from a feed of paper pulp in water which comprises the step of passing the feed through a separator according to any one of Claims 1 to 5, 7 and 10 or a hydrocyclone assembly according to any one of Claims 6, 8, 9 and 11.

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PROVISIONAL SPECIFICATION.

Separator.

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When hydrocyclones are used for removing dirt from paper pulp or stock, difficulties are often encountered owing to the presence of coarse particles in the feed (paper pulp in water) large enough to cause plugging of the apex nozzles of the small diameter hydrocyclones necessary for efficient dirt removal.

Separation of these coarse particles has proved a difficulty. On the one hand, they cannot be removed by screening, since the screens would also hold back the paper pulp itself and soon become blocked. On the other hand, large diameter hydrocyclones, with apex nozzles unlikely to be plugged, are also unsuitable for the purpose, as the continuous apex discharge results in the loss of a considerable amount of valuable fibre along with the coarse dirt particles, which are usually only present in small quantities.

The object of the present invention is to provide a satisfactory separator for removing coarse particles from liquids.

In accordance with the present invention such a separator comprises a vortex chamber in the form of a vessel of circular cross-section, e.g. a cylindrical or cylindro-conical vessel, into which the feed is introduced tangentially and which has an open axial orifice at one end for the discharge of the overflow and a closed axial orifice at the other end with a valve which can be opened from time to time as required to remove the coarse particles which have collected.

The invention is particularly suitable for removing coarse particles from the feed material for a hydrocyclone or a battery of hydrocyclones. In this event the said open axial orifice may lead the overflow direct to the hydrocyclone or battery of hydrocyclones, or it may lead the overflow to an overflow splash head or the like having an outlet or outlets to a hydrocyclone or hydrocyclones; such outlet or outlets may be radial, but are not necessarily so—thus they may be tangential or axial.

One form of separator in accordance with the present invention is shown in the accompanying drawings wherein:—

Fig. 1 is a plan view of the separator; the right half being a section through the line I—I of Fig. 2; and

Fig. 2 is a side view, the left half being in section.

The separator 10 shown in the drawings is cylindro-conical and consists of a cylindrical upper portion 11 and a conical portion 12 leading down to an apex 13 which is closed by a valve 14.

In the cylindrical portion 11 is arranged the tangential feed inlet 15, and across the interior of the portion 11 above the feed inlet 15 is a plate 16 with a central opening in which is located a short pipe 17 whereby the liquid in the separator can pass into the chamber 18 above the plate. The pipe 17 may be omitted, leaving the central opening

in the plate 16 through which the liquid can pass.

The separator shown in the drawings is intended to deal with the inlet feed for up to forty-eight hydrocyclones which are indicated at 19.

At the top of the separator is a flange 20 by which the separator is secured to the underside of an overflow splash head 21 for the hydrocyclones 19. This overflow splash head forms no part of the separator except that it provides a lid to close its upper end.

Near the top of the separator are forty-eight radial outlets 22 from the chamber 18; these outlets can be connected to the hydrocyclones 19 by means of lengths of rubber hose 23. The design of the hydrocyclones forms no part of the present invention; three hydrocyclones are shown in Fig. 2, and the position of twenty-four of the forty-eight hydrocyclones are shown in Fig. 1. Each of the hydrocyclones has an apex discharge at the lower end in the usual way and a central overflow outlet 24 at the top of the hydrocyclone leading into the overflow splash head 21. The overflow splash head 21 is capped by a removable cover 25 and is provided with an overflow outlet 26.

The separator can of course be used for a lesser number of hydrocyclones than forty-eight, by blocking up certain of the radial outlets 22.

The separator is shown in the drawings as having an apex valve 14 in the form of a pivoted flap which, when the separator is in use, can be opened from time to time by an operator to remove the coarse particles trapped at the apex.

Other forms of valve may be used, for example a butterfly valve. The valve may be adapted to be operated mechanically (for example by mechanical linkages, or hydraulically, or electrically) and may be arranged so that it automatically opens periodically to release the coarse particles trapped at the apex.

In addition to providing means of separating coarse particles from the feed, the feed chambers illustrated and described above also provide a satisfactory distribution of the feed between the various hydrocyclones to which the outlets 22 are connected.

The invention is thought to be particularly valuable for use with paper pulp separation, but is not limited to this particular application.

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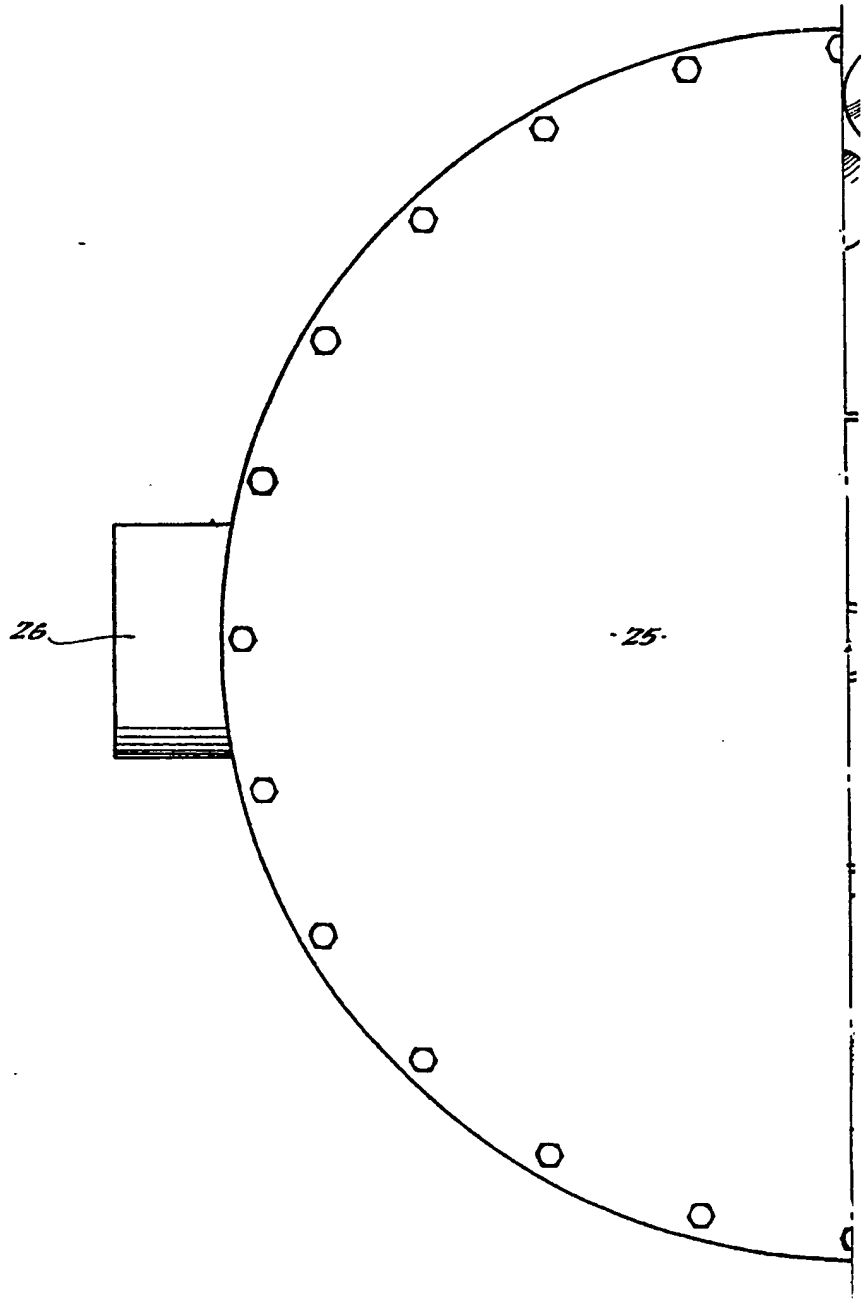
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835,884 PROVISIONAL SPECIFICATION

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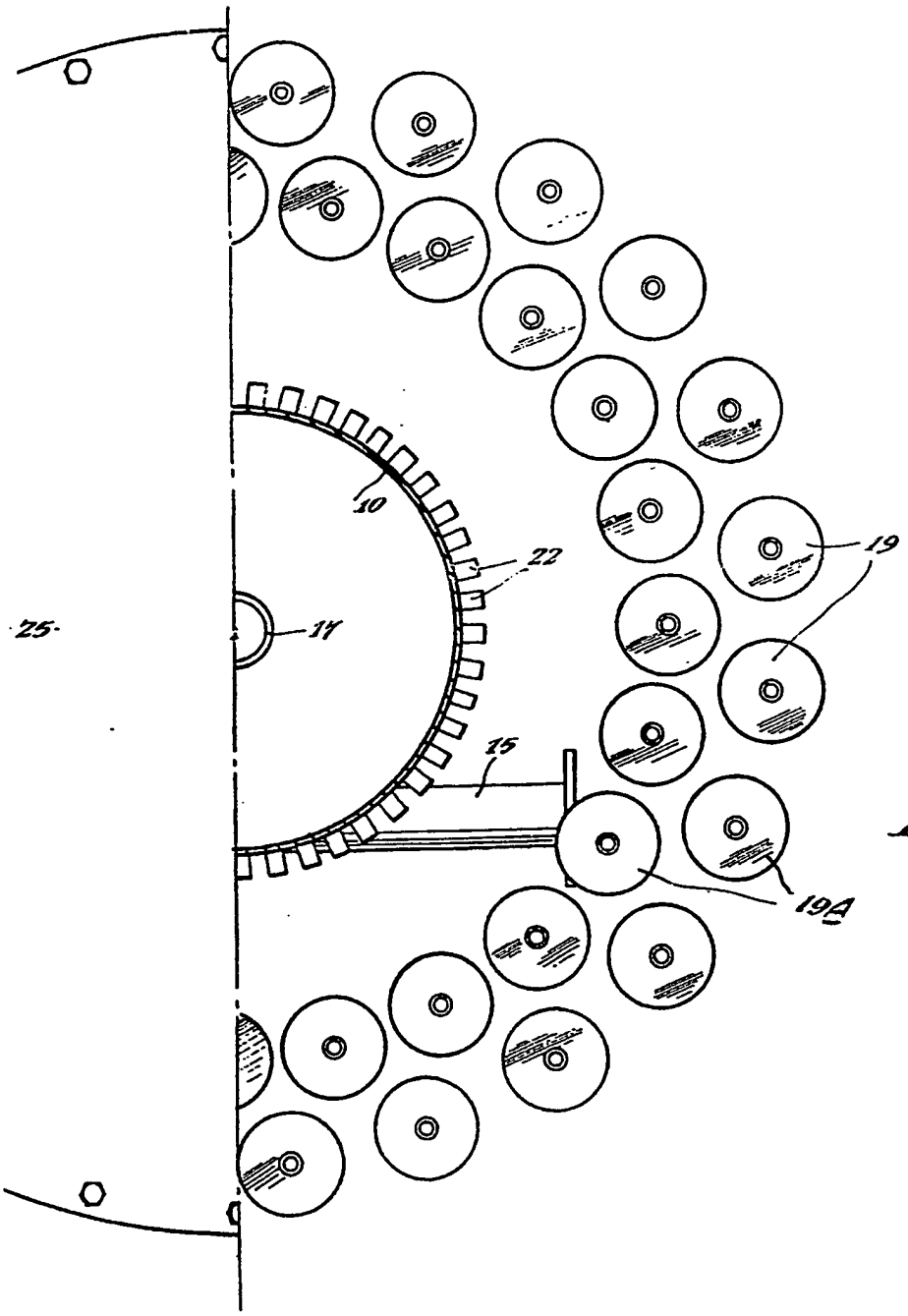


Fig. 1.

835,884 PROVISIONAL SPECIFICATION

2 SHEETS *This drawing is a reproduction of the Original on a reduced scale.*

SHEET 1

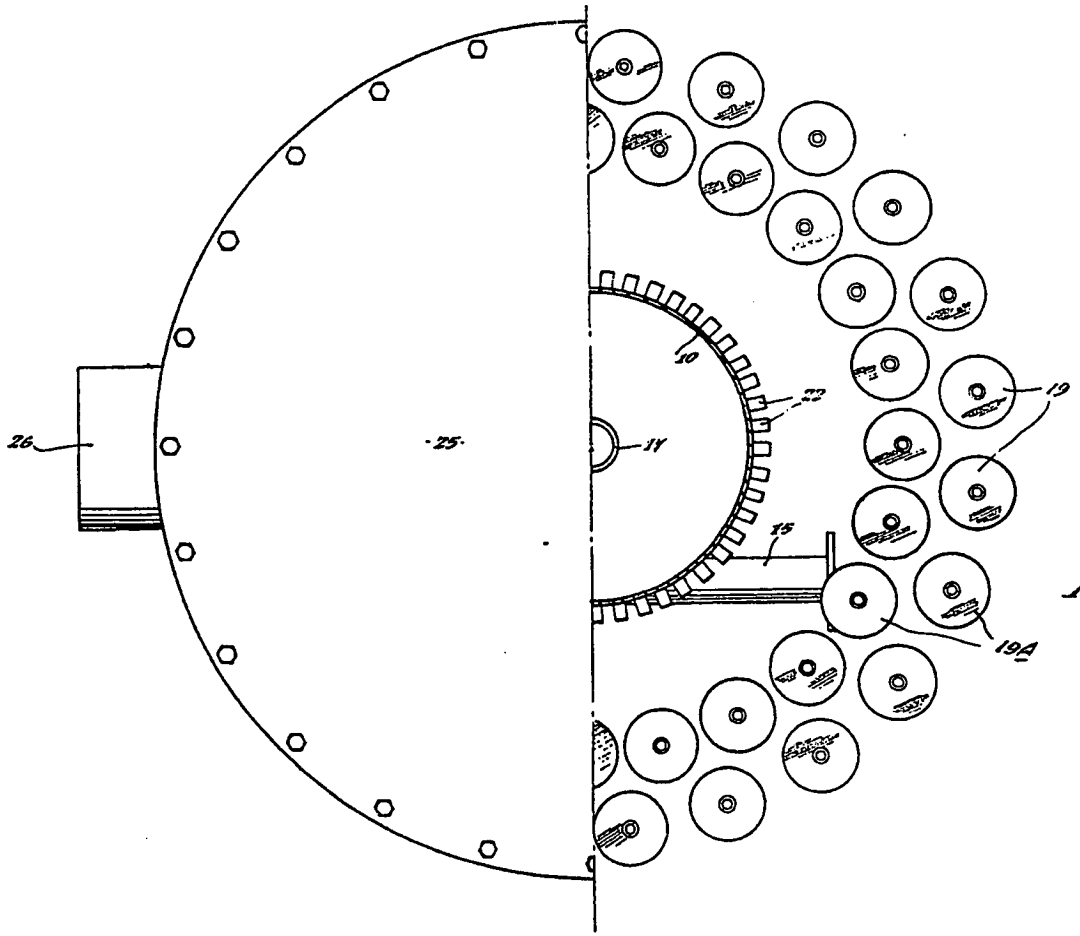
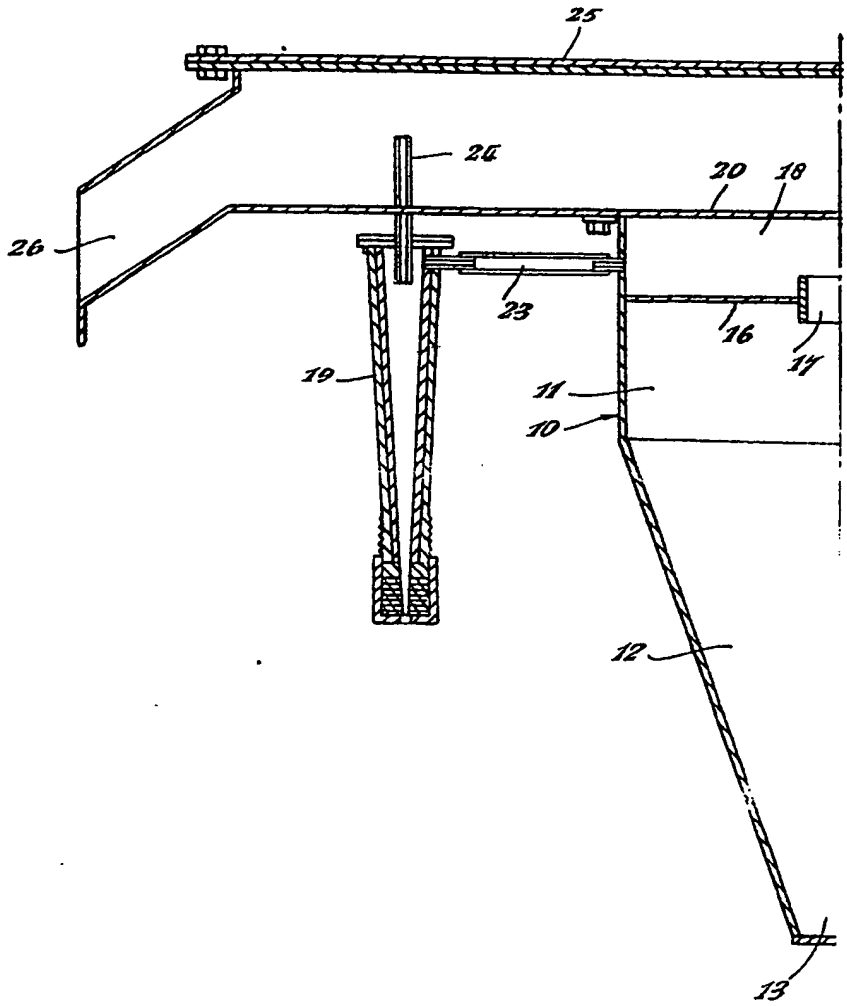


Fig. 1.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835,884 PROVISIONAL SPECIFICATION
2 SHEETS

This drawing is a reproduction of the Original on a reduced scale.
SHEET 2

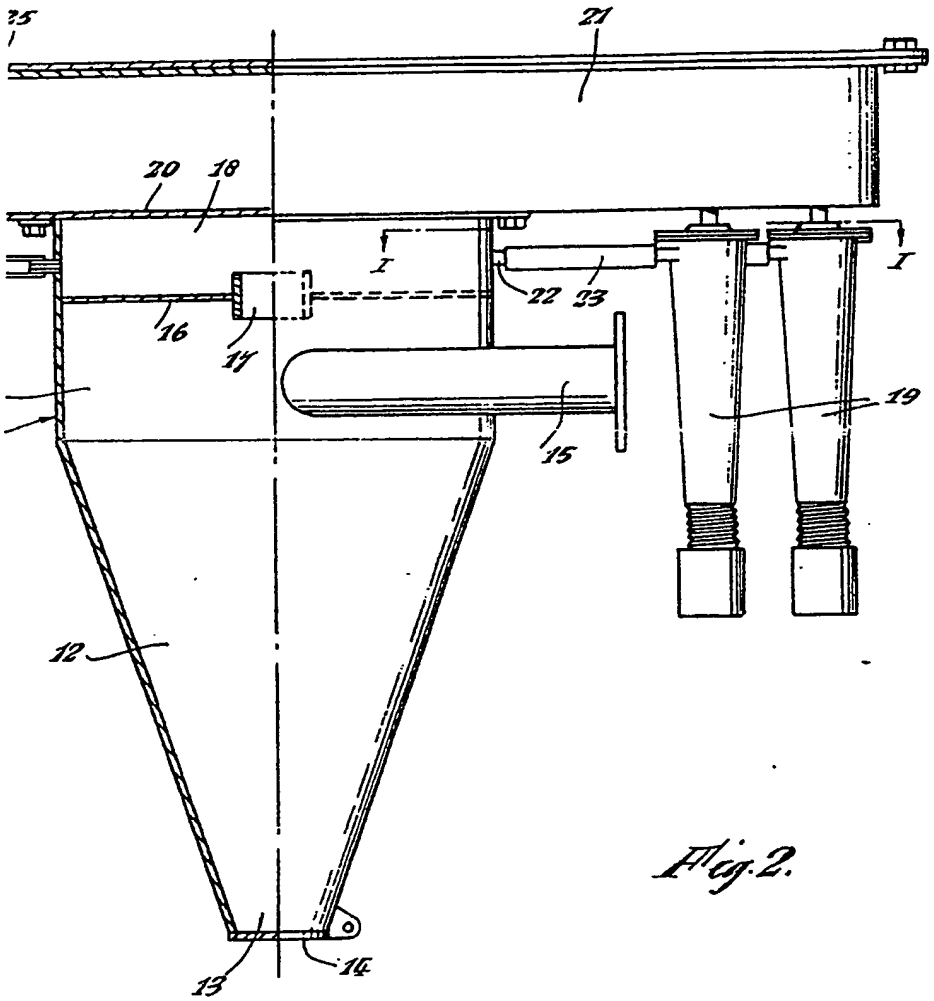

Fig. 2.

835.884 PROVISIONAL SPECIFICATION
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SHEET 2

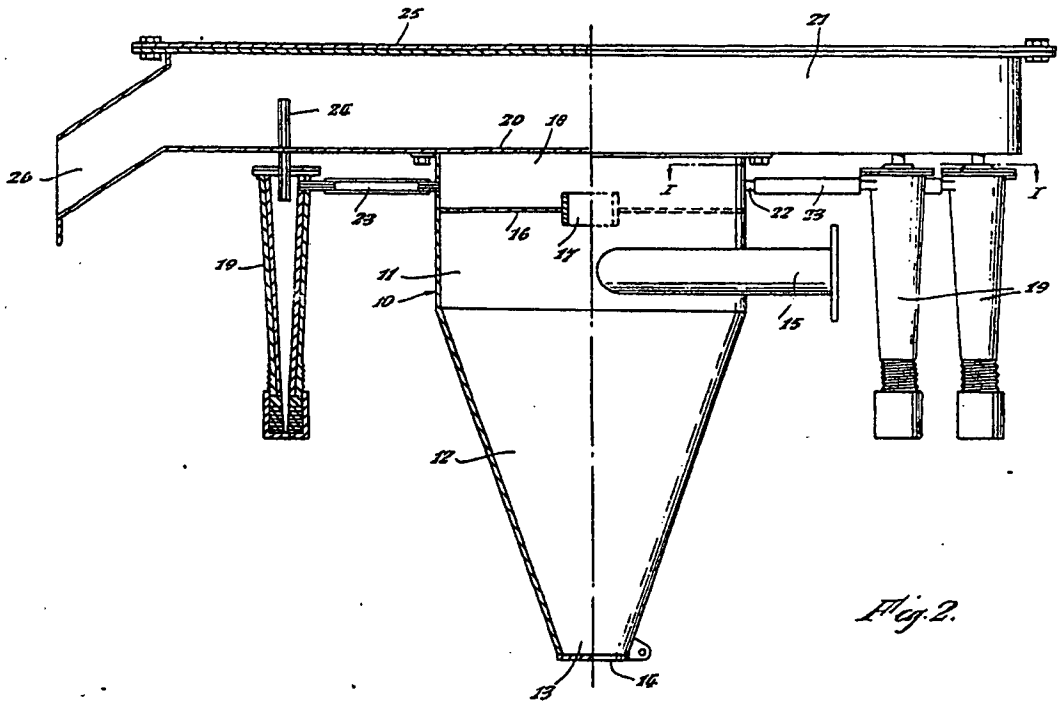

Fig. 2.